

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Élan 3-D Jigs (Project #853)  
**Prepared By:** Eric Chapoulaud / Martha Lomelli  
**Date Prepared:** November 6, 1996

#### A. SUMMARY

This request is for the purchase of a Desktop 3D modeling system to be used along with our *Élan* customized appliance system. The ability to directly produce 3D wax master models from the computer design will allow *Élan* to create full customization including the Pad shape for example. This machine will also be connected to our 3D CAD modeling system SolidWorks, as a rapid prototyping peripheral. This will allow our design team to obtain a 3D physical model of new product design within a few hours, or create small batches of parts to use in clinical tests. The total investment will be \$ 76,900.

#### B. EXISTING SITUATION

Contemporary orthodontic prescriptions rely primarily on norms and principles developed by Dr. Andrews. Individual preferences of leading practitioners have created modifications that form the basis of the prescriptions which clutter the orthodontic marketplace today. Ormco's *Élan* program, has employed sophisticated computer hardware and software to re-examine the existing appliances and techniques, and design a more systematic, state of the art orthodontic appliance system (brackets, molar tubes, archwires and jigs).

In the existing *Élan* system, we use "Vanilla" brackets preforms that are positioned in a milling machine where the final characteristics of the customized bracket are cut into position (Torque and Rotation In Slot, if necessary). This involves two steps as manufacturing has to produce "Vanilla" brackets batches and a second phase of characterization will be performed in our laboratory. While this technique has been proved adequate for the current system, it cannot be improved to add further customization, in the Pad shape, dimension and adhesion surface for example. Moreover, with our current system it is very complex to implement customization for lingual appliances, since not only we need to adapt the torque but also the InOut. Most specifically, since our designs evolve into one piece brackets, the Pad design becomes completely related to the bracket design for labial as well as for lingual appliances.

These new design constraints have led us into switching our CAD software capabilities from 2D to true 3D modeling, in recently investing into 4 SolidWorks CAD workstation seats (CAR # D-0196). Although this new system provides us with nice viewing capabilities of our 3D model designs, it would be sometimes very useful to be able to produce a real model representing the design so as to

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Elan 3-D Jigs (Project #853)  
**Prepared By:** Eric Chapoulaud / Martha Lomelli  
**Date Prepared:** November 6, 1996

verify functionality and scale of our very small parts. Most often, we need to set up small batches of parts of our new design to send to our clinicians for clinical tests purpose. The current method involves setting up R&D temporary tooling and manufacturing process to produce such batches, and therefore has a tooling and labor cost.

### C. PROPOSED SOLUTION

We believe that the *Élan* appliances, when properly used as an integrated system, will provide more effective and efficient orthodontic treatment, at lower cost and with measurably better outcomes in every aspect that is important to both orthodontist and patient. Along with our investigating clinicians, we also think that *Élan* system will gain better accuracy and quality if completely customized.

Our new *Élan* software provides us the ability to automatically create 3D CAD bracket designs from a set of parameters such as Torque, RIS and also size and shape (Diamond angle). It will be further improved to allow complete customization of the Pad for example. While investigating methods of manufacturing to be used with this feature, we have evaluated rapid prototyping equipments that produce 3D models directly from 3D designs. After different feasibility tests, we have singled out the Model Maker machine manufactured by Sanders Prototype Inc. (Wilton N.H.). This machine has the capabilities to produce Wax models with a tolerance of +/- 0.0005 inches that can be used as investment casting patterns. This machine provides software to process CAD files and produce the wax representation of the model. It is possible to link this machine's software to ours so that we can produce almost automatically fully customized bracket designs. In order to produce the final part, we would cast the wax patterns, using standard techniques that we know well.

The Model Maker machine can be connected to our 3D CAD workstations as a rapid prototyping peripheral. This device uses standard CAD formats and produces wax patterns within our tolerances and in a sufficiently short time. It can operate unattended, at night for example.

### D. INVESTMENT REQUIRED and RETURN ON INVESTMENT

The Model Maker II cost is \$ 64,900 for the new version that will be available in June 1997. Sanders Prototype proposes a deal that includes delivery of the current version of the machine at the current price \$ 59,900 and a switch to the new version when available for an additional \$

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Elan 3-D Jigs (Project #853)  
**Prepared By:** Eric Chapoulaud / Martha Lomelli  
**Date Prepared:** November 6, 1996

15,000. Two days of training are included in the price. Support is free for the first year (Additional years of maintenance can be bought for \$ 6000).

We believe that this machine represents an opportunity for us to step forward in the direction of completely customized appliances that could not be possible in a cost effective way otherwise, for labial and lingual appliance as well. Model Maker from Sanders will also allow us to reduce our new product development costs by shortening our development process during the new product design phase. by having the in-house possibility of verifying functionality and tolerances on real models, costly design errors can be corrected at the design phase instead of after the pre-production phase. Such a machine reduces delays in bringing new products to the market, by reducing the number of iterations during the development and the pre-production phase. Finally, it gives us a definitely cheaper and faster way of producing small batches of new products that can be used for clinical tests.

#### E. RISKS and OPPORTUNITIES

During the evaluation of this machine, we have performed a number of tests that have been successful. We have created a 3D CAD design using our 3D Modeling workstation and have been able to create a wax pattern for investment casting within our tolerance specifications. We also have been testing successfully the possibility of producing customized brackets designed with our *Élan* software. Tolerances were also correctly observed. Although the Model Maker from Sanders is a new technology that will certainly improve in the future, we believe that this machine is presently able to produce parts that fit our needs.

#### F. RISK MANAGEMENT

A visit to Sanders facilities was able to show confidence in their ability to train and support new customers. Their software has been continuously improved for more user friendly functions and reliability. The new version of the machine available next year will improve speed, reliability and pattern material.

#### G. ALTERNATIVES

One possible alternative is to "do-nothing". This means that the *Élan* system will continue to produce parts through a two step process. From "Vanilla" brackets the design of which is costly and

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Elan 3-D Jigs (Project #853)

**Prepared By:** Eric Chapoulaud / Martha Lomelli

**Date Prepared:** November 6, 1996

difficult to change. It also means that we would not be able to rapidly test new products at the design phase or at the clinical test phase.

Our evaluation of the rapid prototyping offers at the moment showed that no other machine is able to produce our small parts within our tolerances. Our visit at Sanders demonstrated their commitment into solving our specific needs for the *Élan* system. They are able to set-up more strict specifications for us during their manufacturing process so that our machine would have even better tolerances. Finally Sanders offers the least expensive solution currently marketed for rapid prototyping.

#### H. INVESTMENT BREAKDOWN

An investment of \$ 76,900 will be required to acquire the Model Maker II machine from Sanders Prototype Inc. Pending shipment of the Model Maker II unit (Spring '97), a MM6-PRO (as quoted) will be installed for our use. When Model Maker II is available, Sanders Prototype will then replace the interim unit, install the new machine, and restart a 12 months warranty. Details of the capital investment are as follows:

#### CAPITAL:

1.	ModelMaker Unit	\$ 59,900
2.	Spare Printhead (Build and Support)	\$ 1,000
3.	MM6-PRO Interim program	\$ 15,000
	<b>TOTAL</b>	<b>\$ 76,900</b>